

Developing Robust Messages from Climate data



Maximising communication and
effectiveness for end-users



Winter School 2009
Peter Johnston

Weather forecasts

EXTENDED FORECAST

FRI	SAT
	
am : wind	am : drizzle
am : Windy pm : Showers	am : Drizzle pm : Showers
17 9	17 10
RAIN: 50 %	RAIN: 30 %

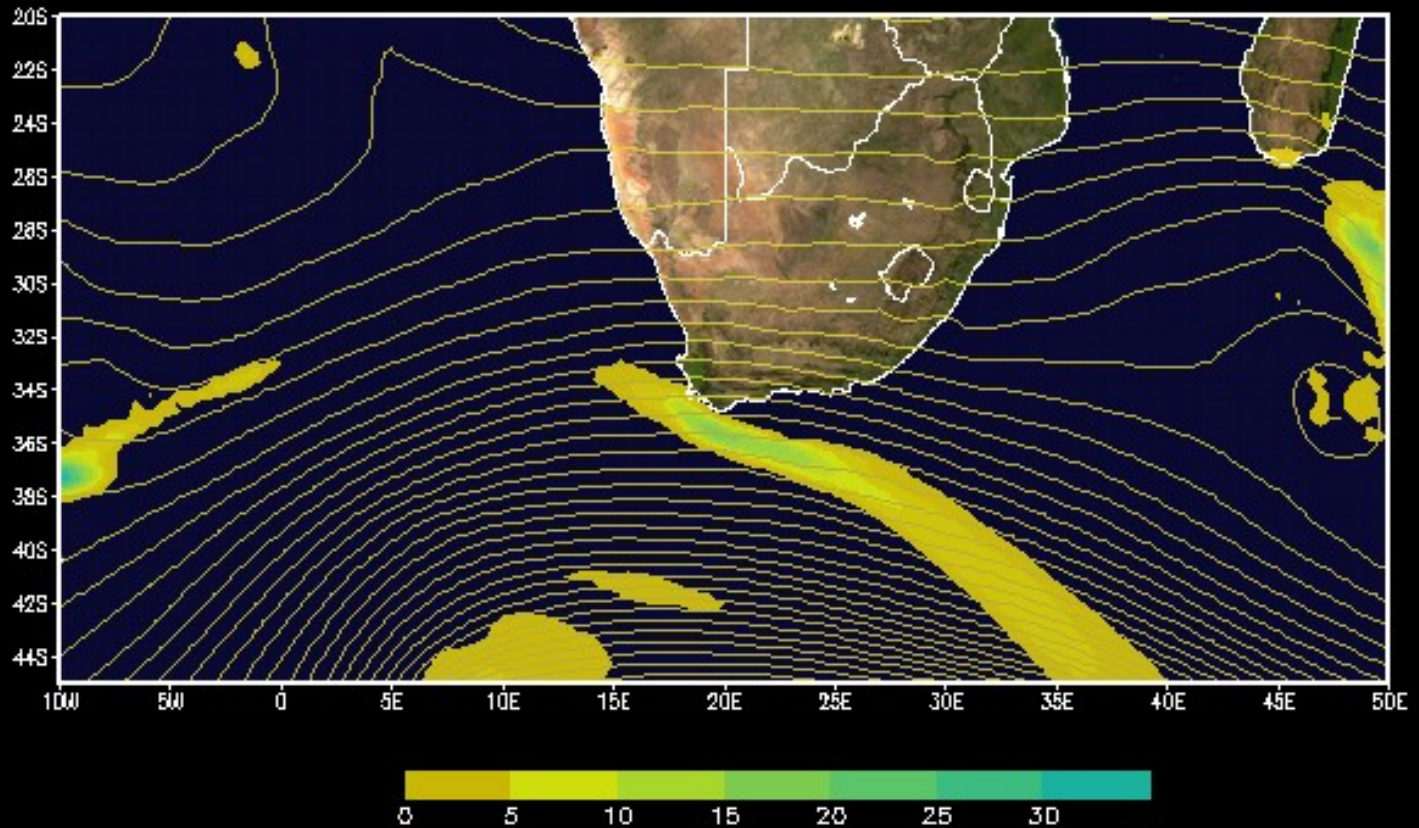
WIND INFORMATION (km/h)

am NW 20-30	am W 20-30
pm NW 20-30	pm W 10-19

FORECAST SUMMARY

FRI	Rather windy & Variable, 50% chance of showers
SAT	Overcast with drizzle, chance of showers later to fresh later
SUN	Variably cloudy to partly cloudy
MON	Partly cloudy and mild, moderate winds from the WNW
TUE	Partly cloudy to Sunny and mild, Moderate winds from the WNW becoming moderate to fresh later

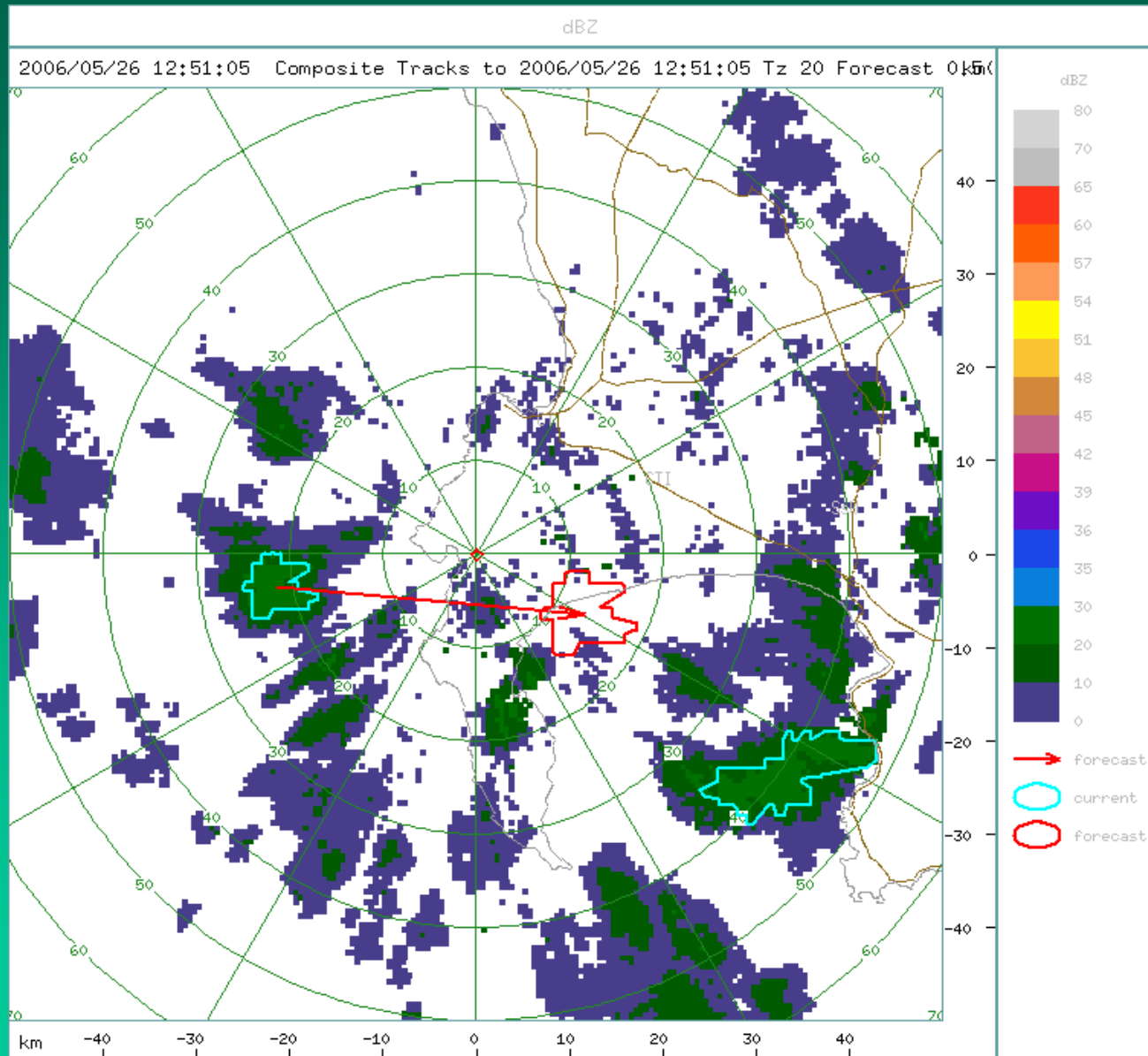
Fri, 26 May 2006 12:00 6 hr accumulated rain (mm) (500hPA height contoured)



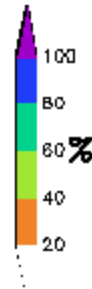
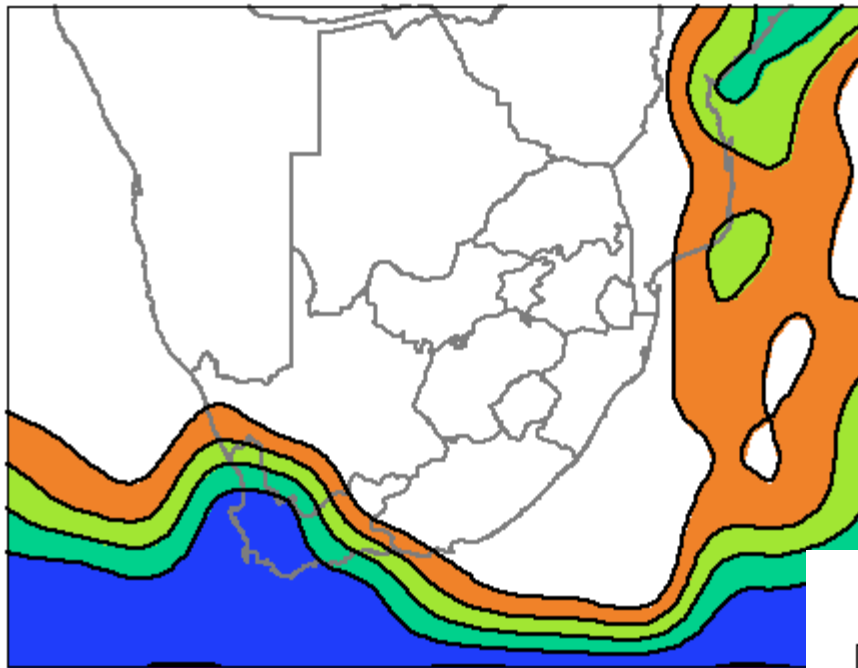
Forecast is approximately 9 hours old

www.iafrica.co.za

Radar - <http://metsys.weathersa.co.za>

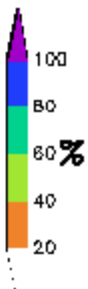
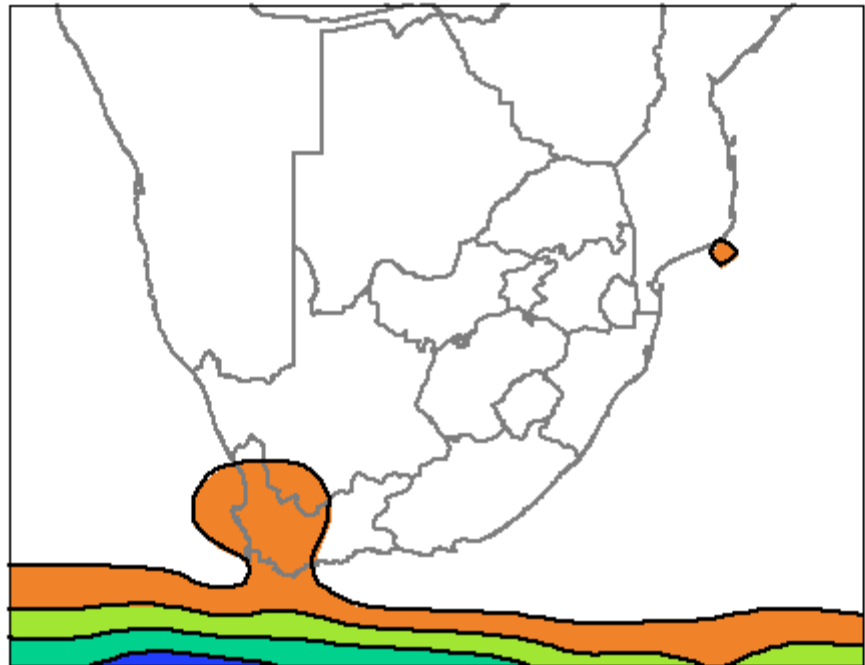


Probability of regional total rainfall exceeding 5 mm
for the period 2 Jun 2006 to 8 Jun 2006



2 week forecast

Probability of regional total rainfall exceeding 20 mm
for the period 2 Jun 2006 to 8 Jun 2006



www.weathersa.co.za

11-30 day forecast

Expected Total Rainfall for the period 31 May – 19 June 2006

AREA 1:

20% chance that the total rainfall for this period will be ABOVE-normal.

45% chance that the total rainfall for this period will be normal.

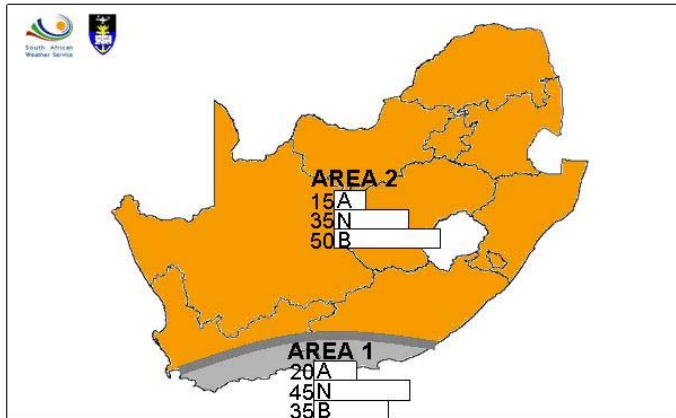
35% chance that the total rainfall for this period will be BELOW-normal.

AREA 2:

15% chance that the total rainfall for this period will be ABOVE-normal.

35% chance that the total rainfall for this period will be normal.

50% chance that the total rainfall for this period will be BELOW-normal.



Please send comments to longrange@weathersa.co.za

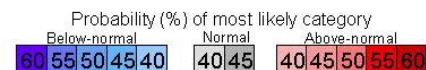
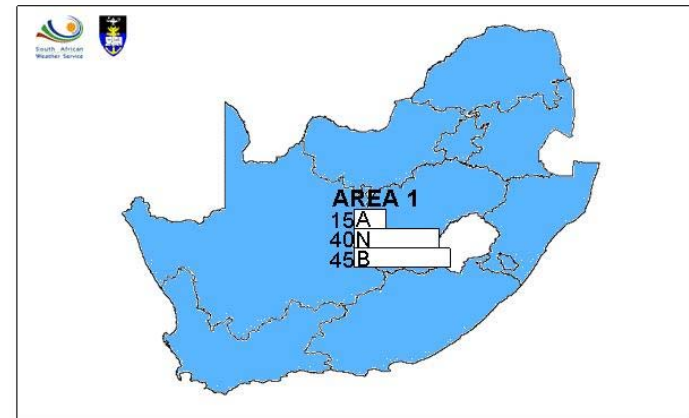
Expected Mean Temperature for the period 31 May – 19 June 2006

AREA 1:

15% chance that the mean temperature for this period will be ABOVE-normal.

40% chance that the mean temperature for this period will be normal.

45% chance that the mean temperature for this period will be BELOW-normal.



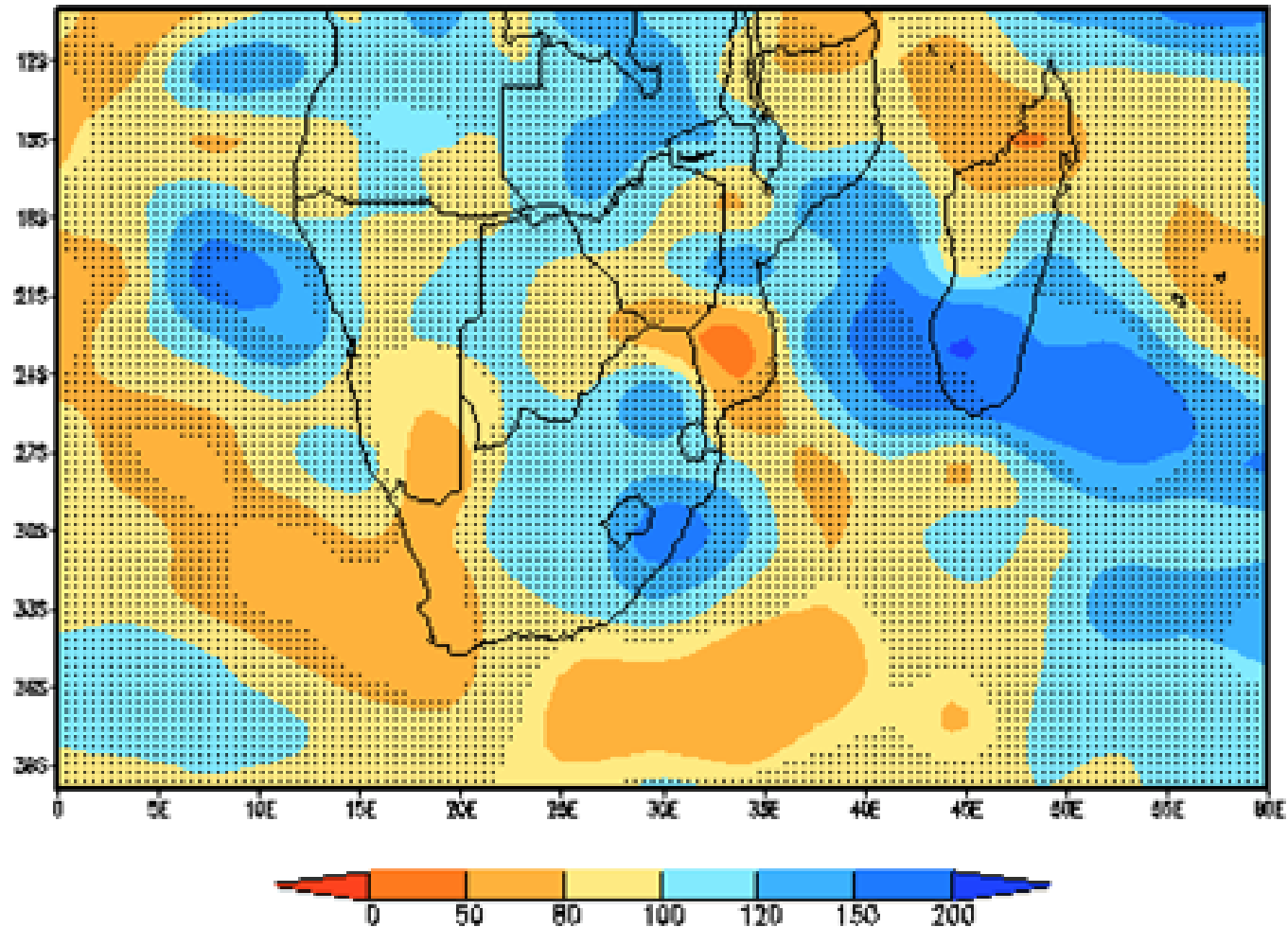
Please send comments to longrange@weathersa.co.za

Monthly forecast – 1-3 lead time

Precipitation Forecast

July 2006

% of Normal



www.gfsa.net

Terminology

$$\bar{x} = 237 \text{ mm}$$

- Normal (237 +/- 10% = 210-260 mm)
- Above Normal (above 260mm)
- Below Normal (below 210mm)

20% chance that the total rainfall for this period will be ABOVE-normal.

35% chance that the total rainfall for this period will be normal.

45% chance that the total rainfall for this period will be BELOW-normal.

20

35

45

55

80

37

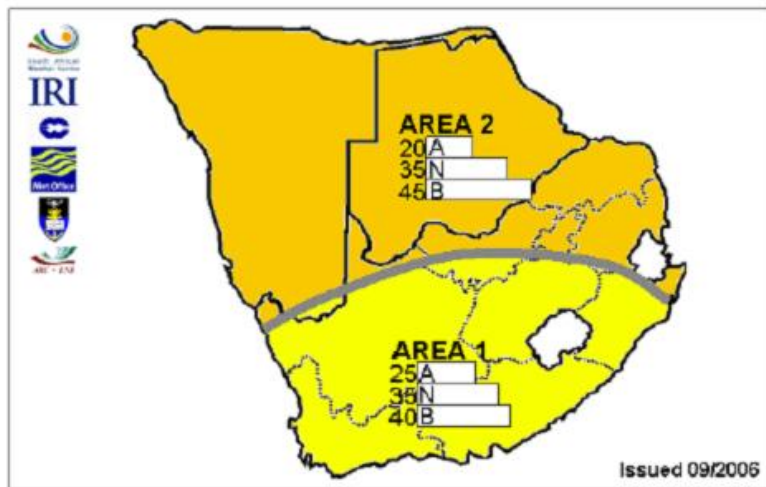
63

- % of normal predicted: 80% = 168mm
60% = 126mm
40% = 84mm
- 40-60% of normal = 84-126mm
- 100-120% of normal = 237-284mm

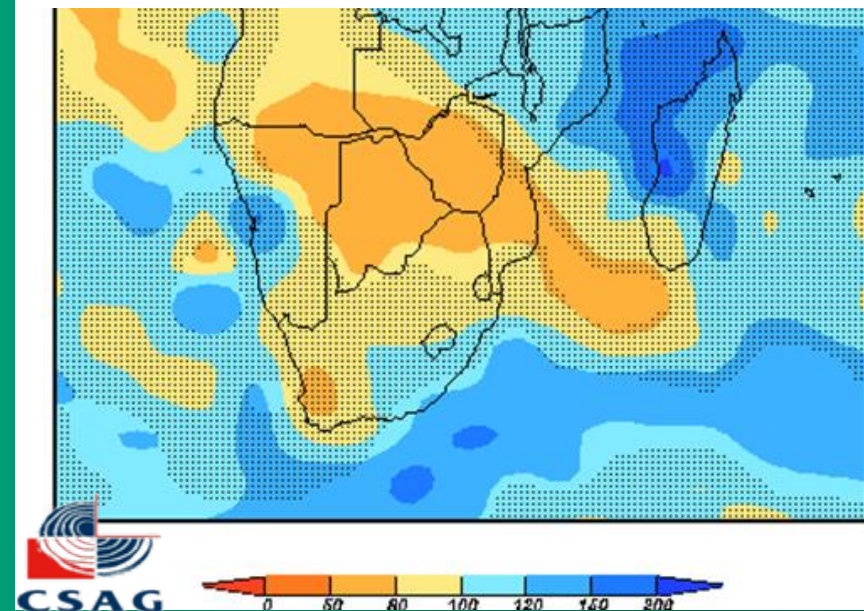
Seasonal forecasts?

- 3 month regional scale projections produced for 1,2,3 month lead times

Expected Total Rainfall for the period
October-November-December 2006

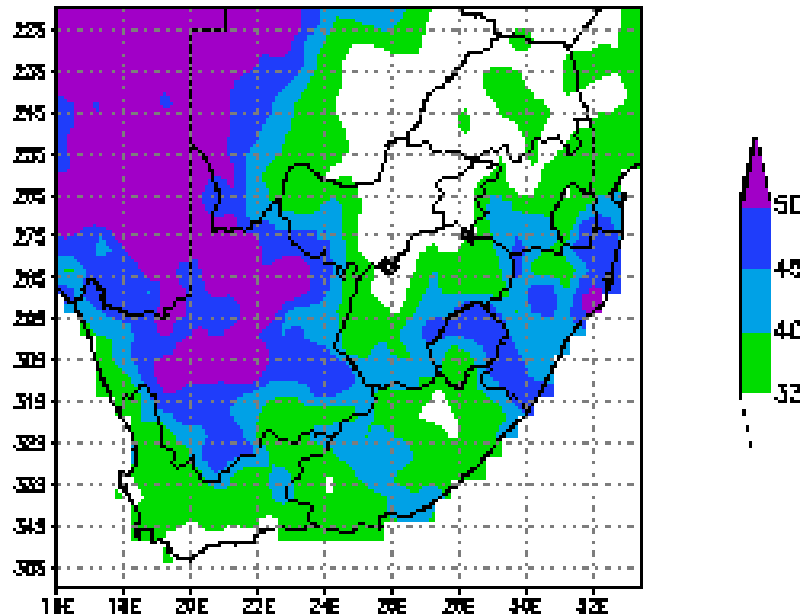


OND 2006
Precipitation forecast (% of Normal)

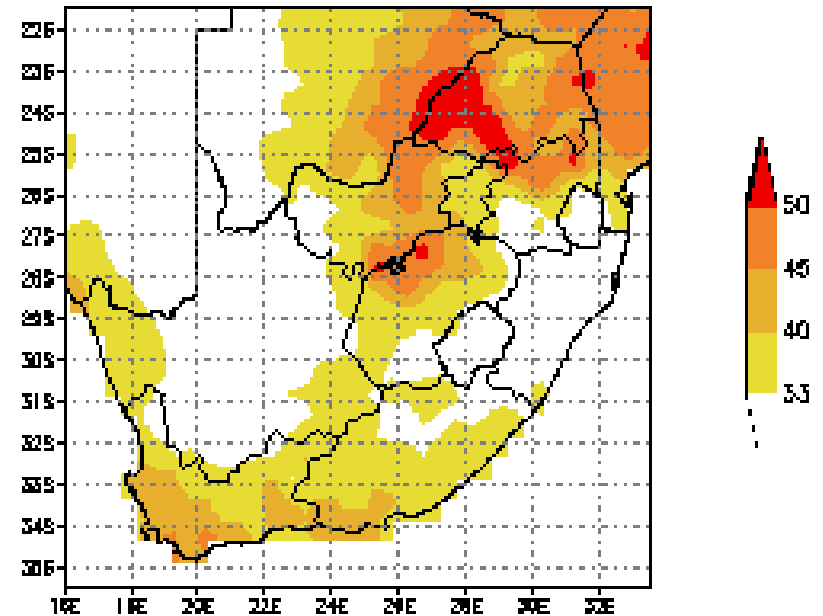


Latest from SAWS

OND 2008
Above-Normal Rainfall

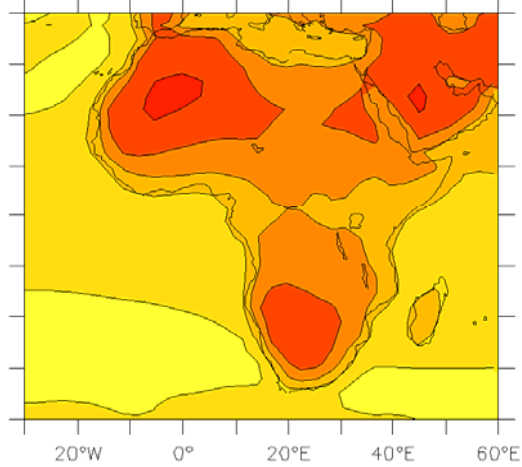


OND 2008
Below-Normal Rainfall



Climate Change Projections

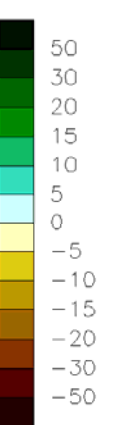
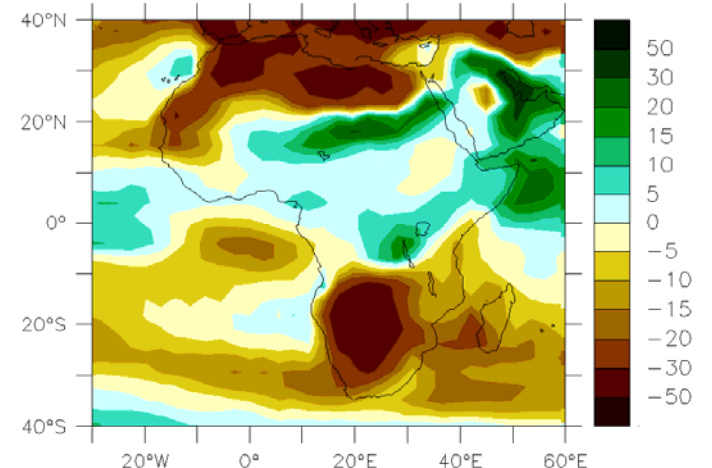
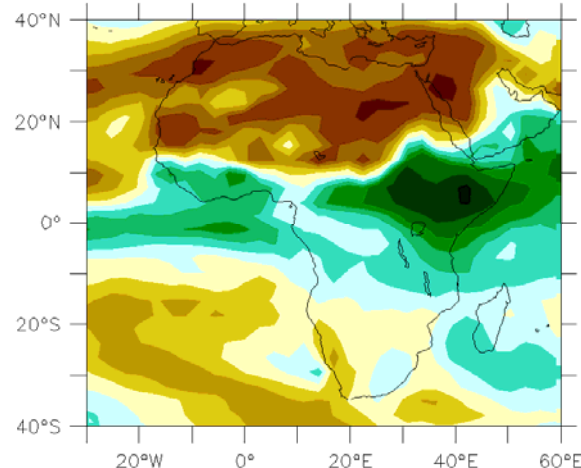
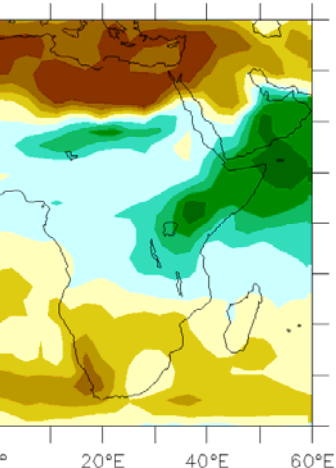
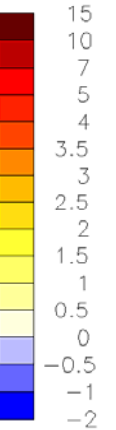
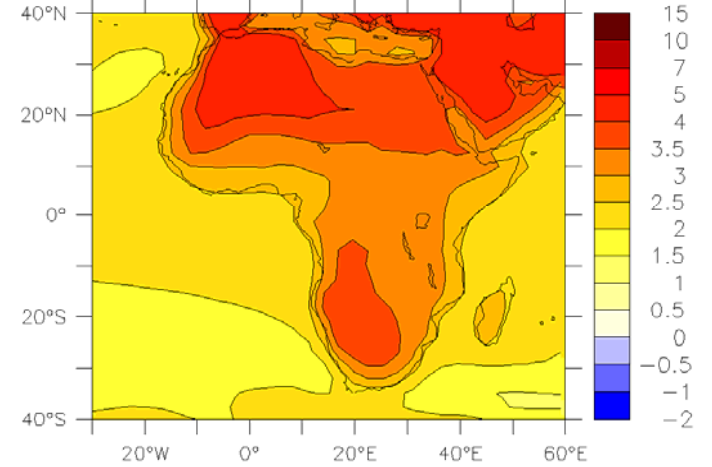
Annual



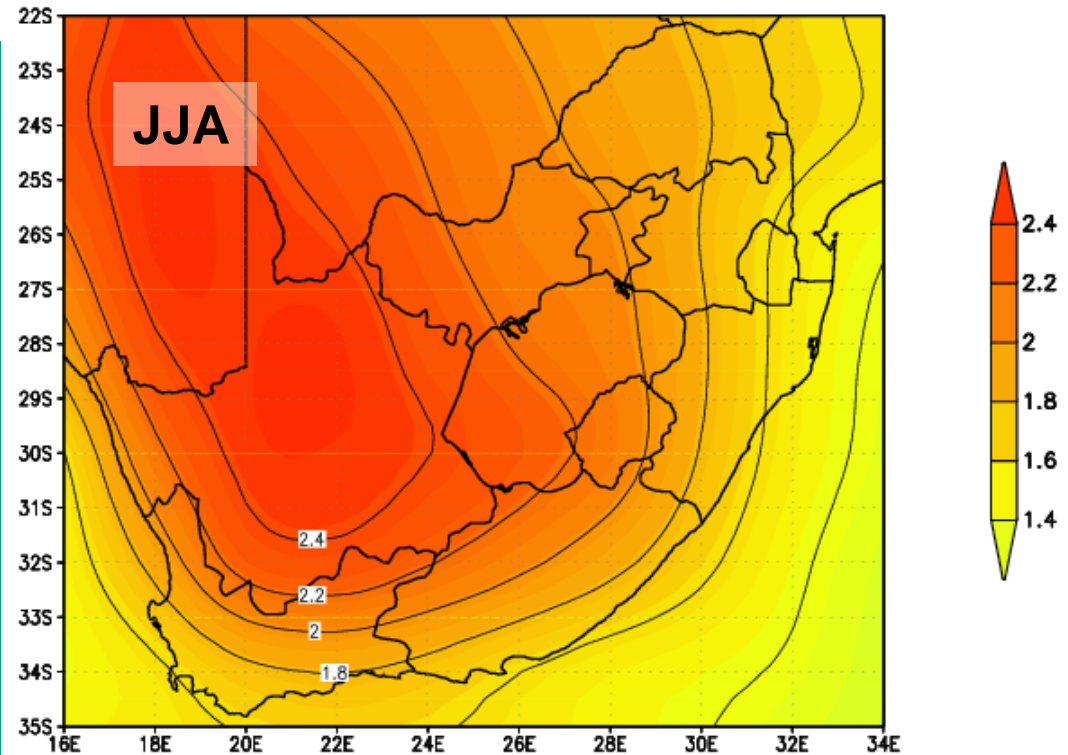
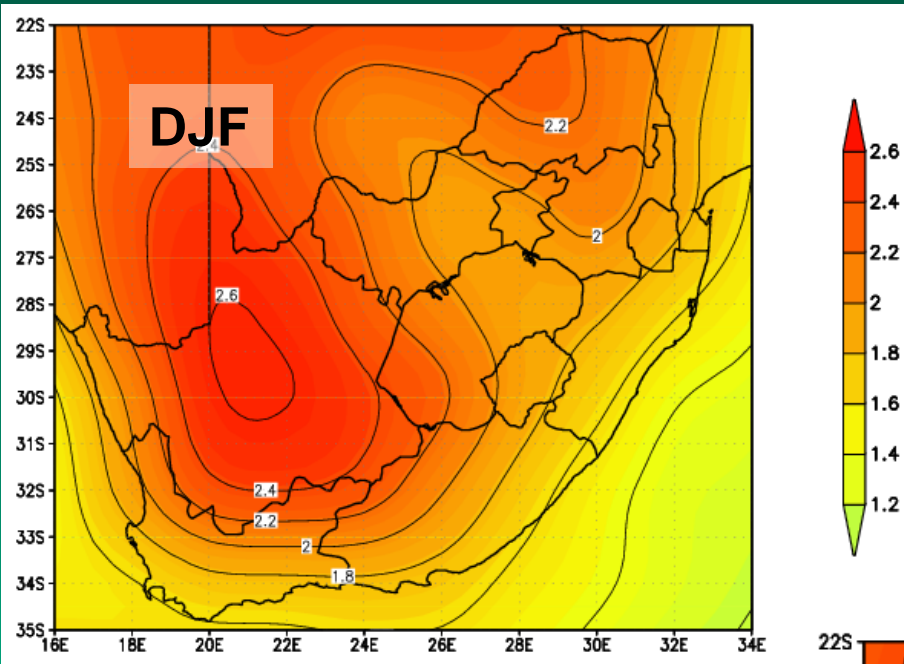
DJF



JJA

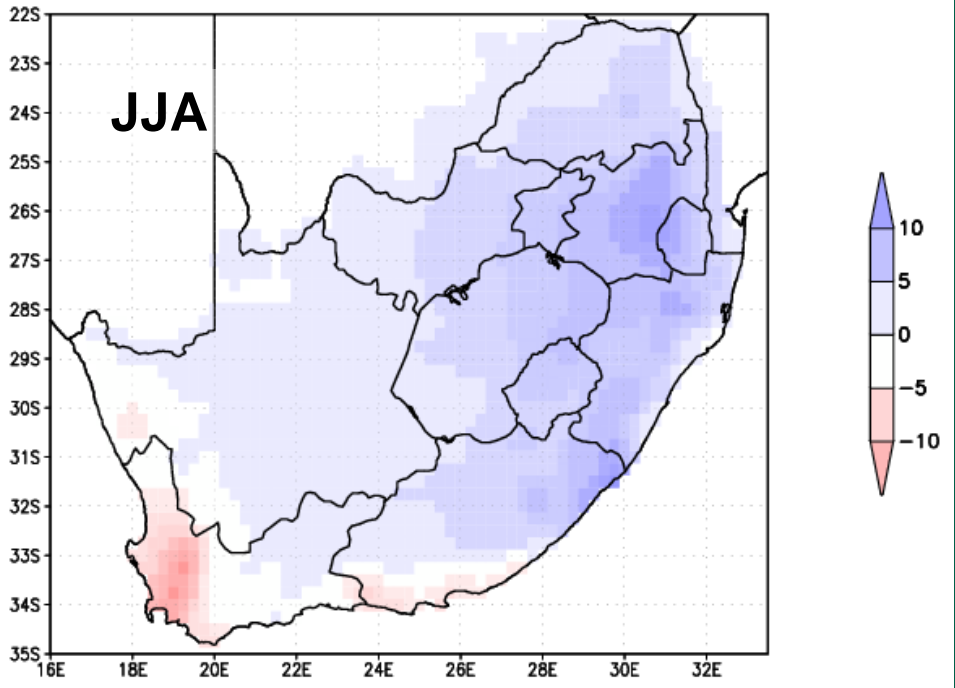
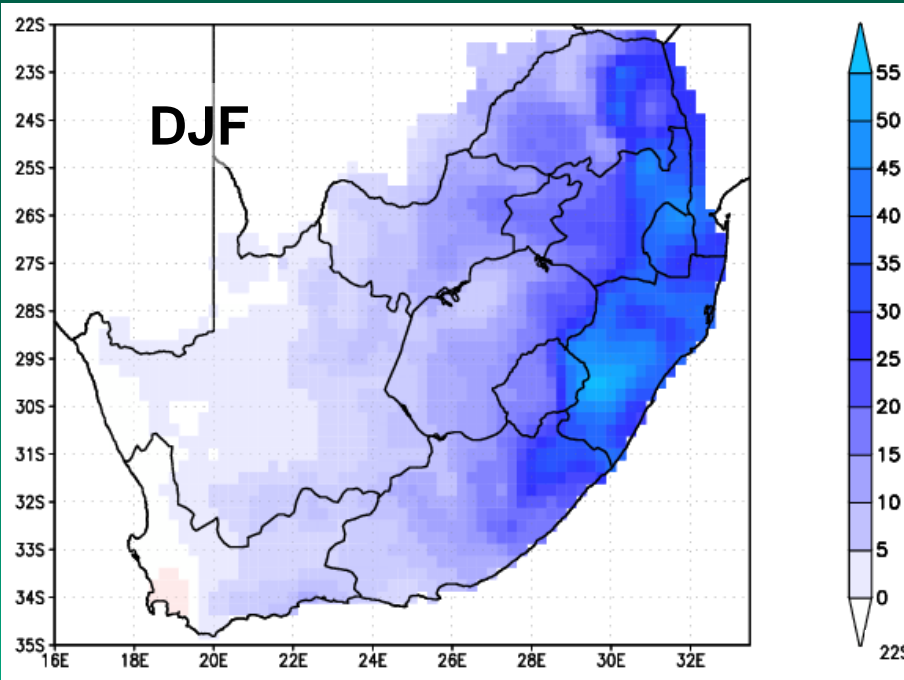


Temperature 2030-2040



What's the chance?

Rainfall 2030-2040



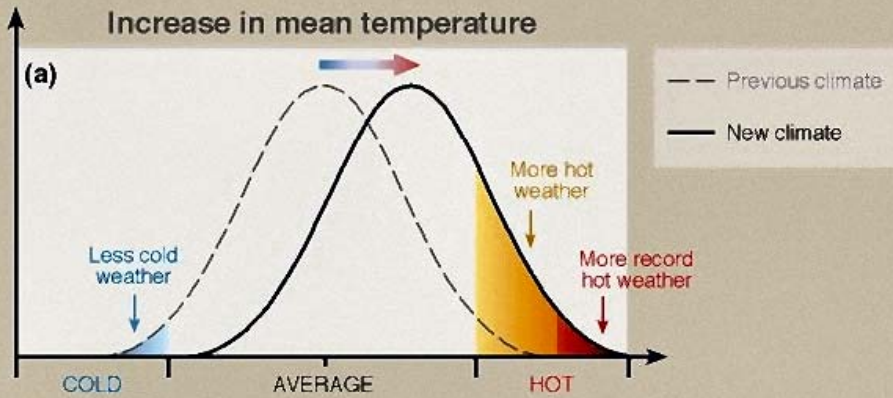
What can/can't they do?

- Broad scenario for future period – 30/50/100 years
- Show envelopes of future conditions
- Direction of change in rainfall

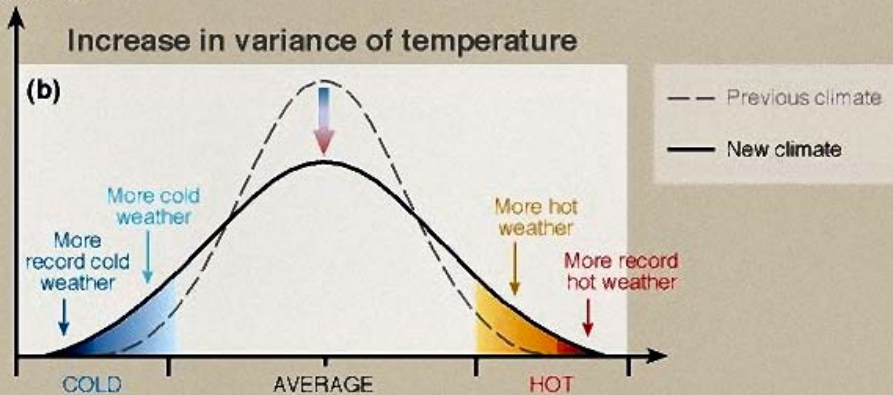
Can't yet..

- Be specific about size of changes
- Have high spatial resolution
- Show inter-decadal variation
- Show drought and flood frequency

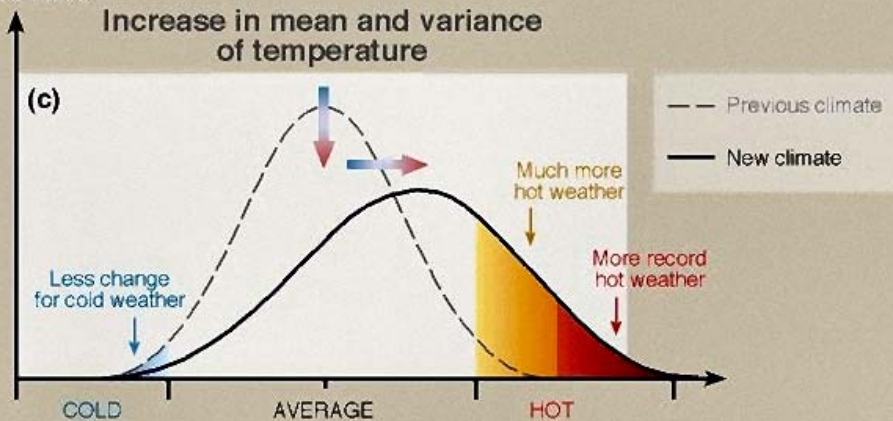
Probability of occurrence



Probability of occurrence



Probability of occurrence



How is change manifest?

Communicating information

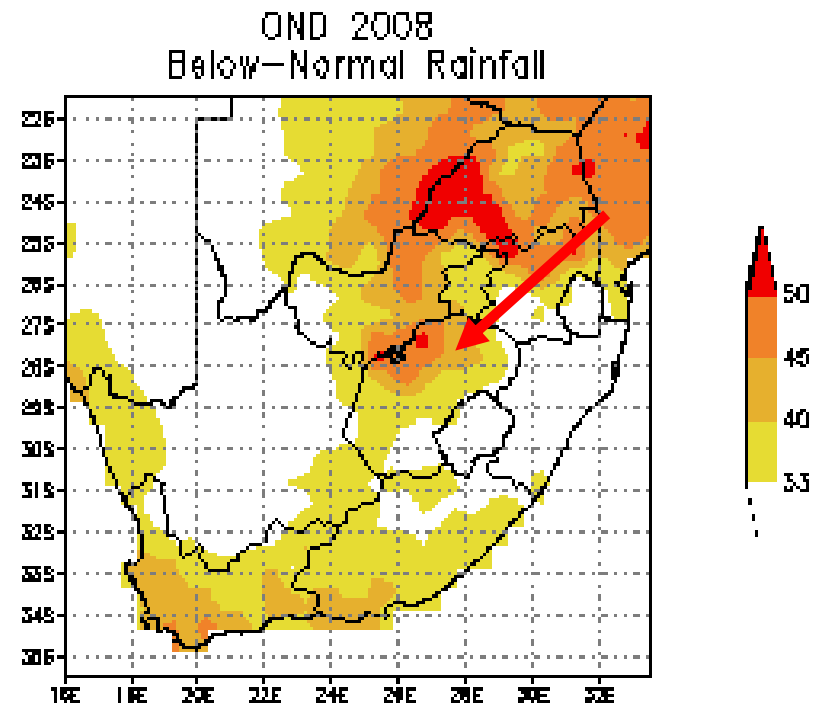
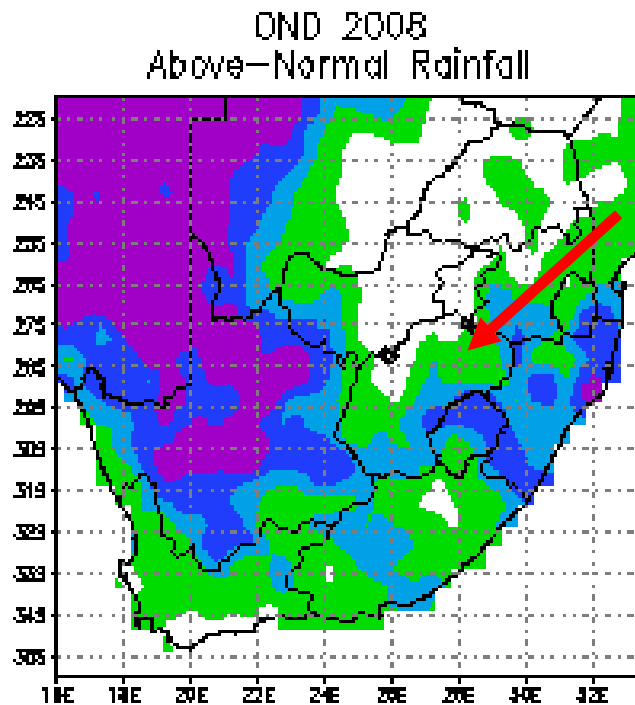
- Climate change information should include broad trends and future conditions
- Should also use crop/water modelling for strategic planning
- Must keep up to date with best science
- Must question value to individual user
- Use indigenous knowledge combined with science to explain options for adaptation
- But perhaps use SF as communication thrust?

Forgotten forecasts?

- 3 month regional scale projections produced for 1,2,3 month lead times
- **Access** very limited
- **Understanding** low
- **Usefulness** – marginal
- **Potential benefits** – medium to high

Interpretation?

- Free State – 33-40% chance of AN
40-45% chance of BN
- Can they expect NORMAL?



Scorecard 2007

- ACCESSIBILITY – where/how 2/10
- VALIDITY - skill, accuracy 3/10 -
(some studies)
- PERTINENCE – scale, frequency, 3/10
interpretation

8/30 = 26.7%

Comment: *Could Do Better!*

Requirements – nothing new..?

- Temperature outlook

- Overall
- Extremes
- Frost?

- Rainfall outlook

- Onset
- Overall
- Mid-season drought
- Cessation

User responses - Reliability

1. **Accuracy – will it be correct?**
Probability/likely/confidence?
2. **Skill – how often will a forecast be correct?**
3. **Scale – usefulness?**
4. **Consistency – will the forecast for a particular month change?**
5. **Will I be able to interpret it?**

User responses - Reliability

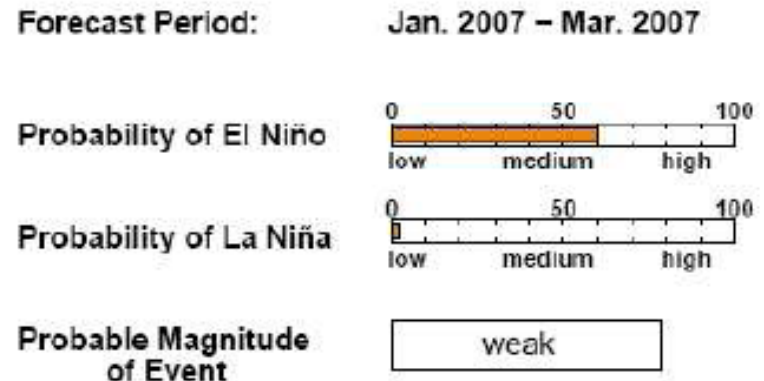
1. Accuracy – will it be correct?

Probability/likely/confidence?

“The 90% significance level (according to a students T-test) indicates where the model is more *confident* that the forecast is different to climatology.”

“El Niño conditions are *likely* to continue into early 2007, and are normally associated with below-normal rainfall conditions over the larger part of the forecast region”

Current ENSO Forecast Summary¹



Not enough information!

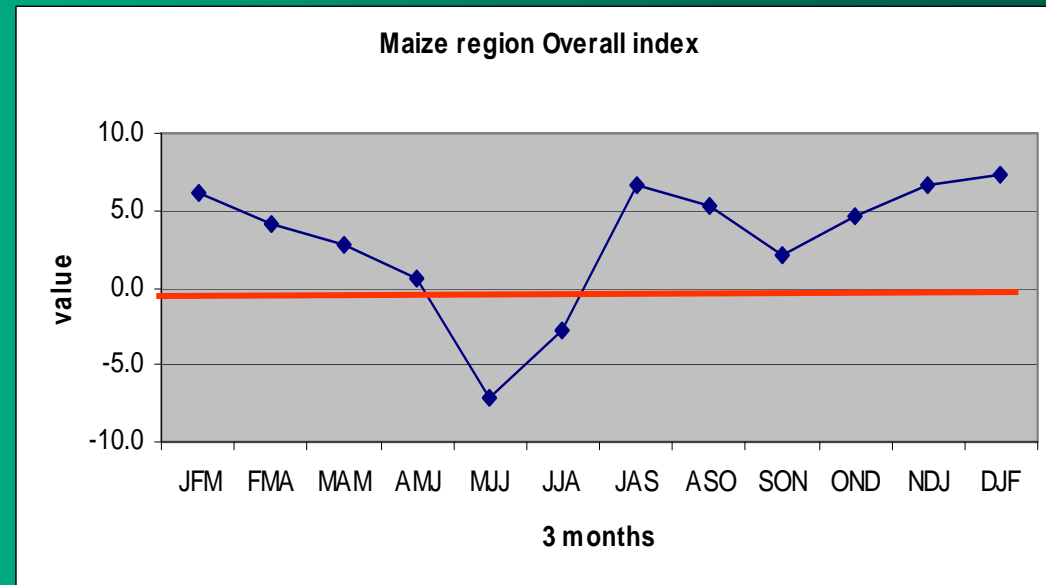
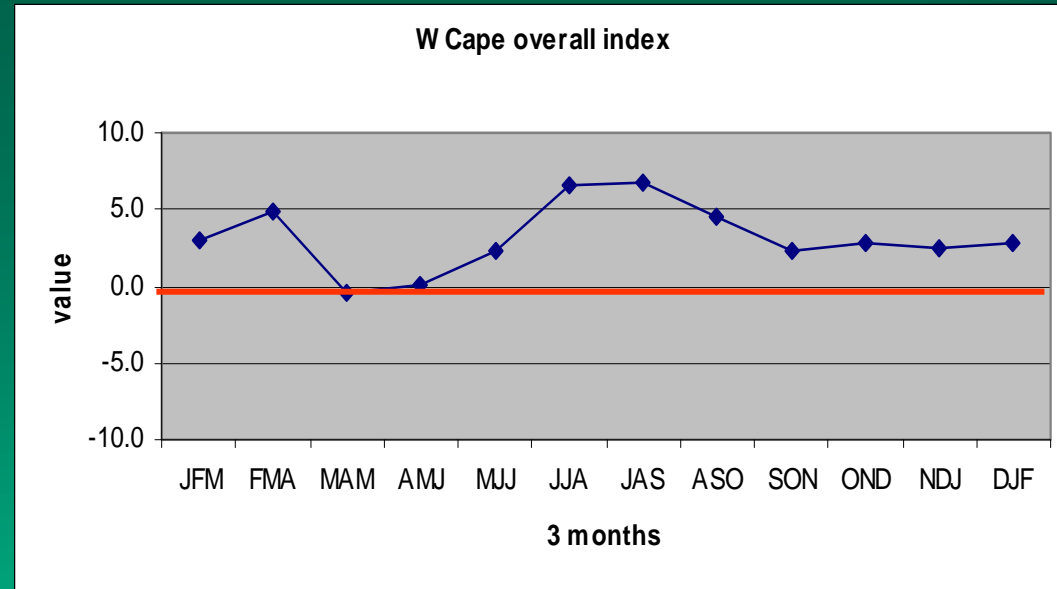
- **What will the ENSO event mean?**
 - Delayed onset of rains?
 - Dry months/drought?
 - Hot temperatures?
- **Which crops are more susceptible?**
- **Worst and best case scenarios...**
- **Typical responses in analogue years..**

2. Skill – how often will a forecast be correct?

- How often do you get it right?**
- Where is it more skilful?**
- Which periods does it have most skill?**
- Can you predict the onset?**
- Do you do any follow-up?**
- Where can I find it?**

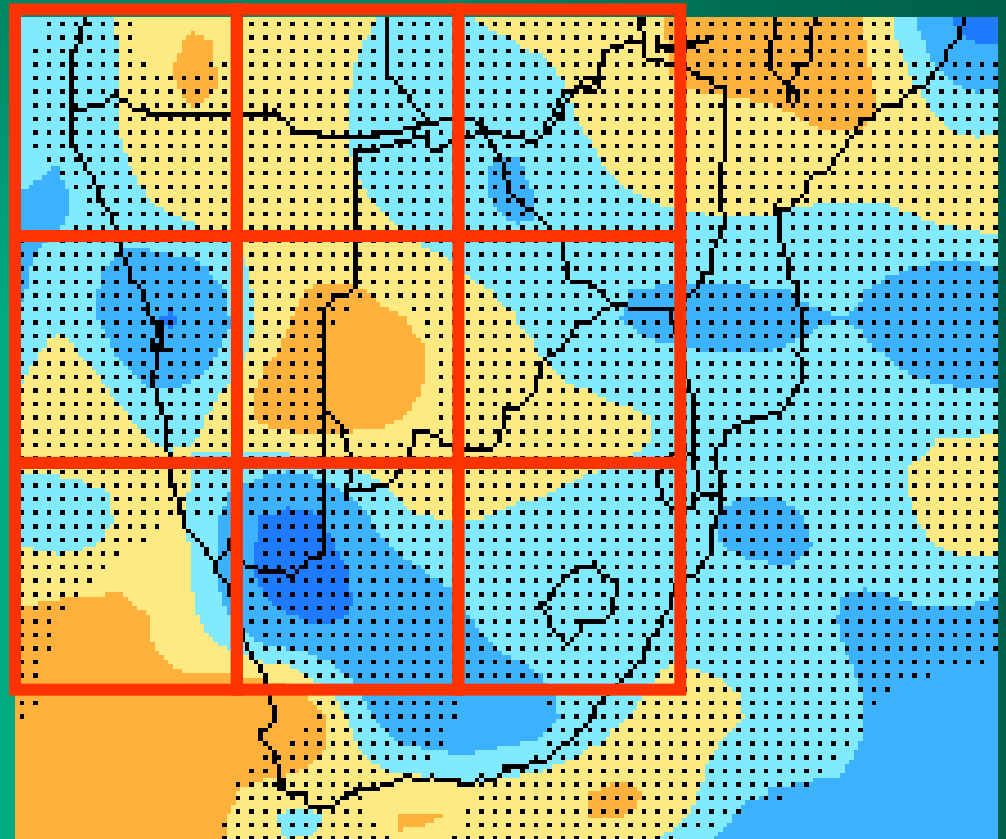
Possible response

- Verification showing success rate, times, regions
- Ongoing work wrt onset etc
- Uncertainties explained
- Don't issue low-skill forecasts

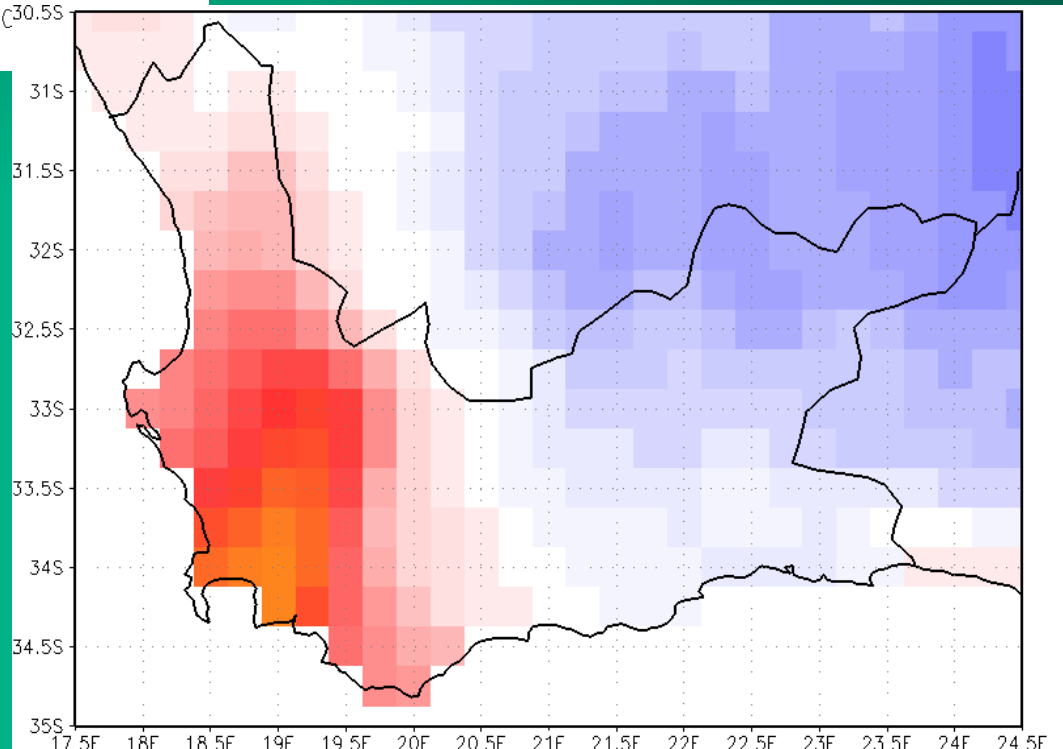
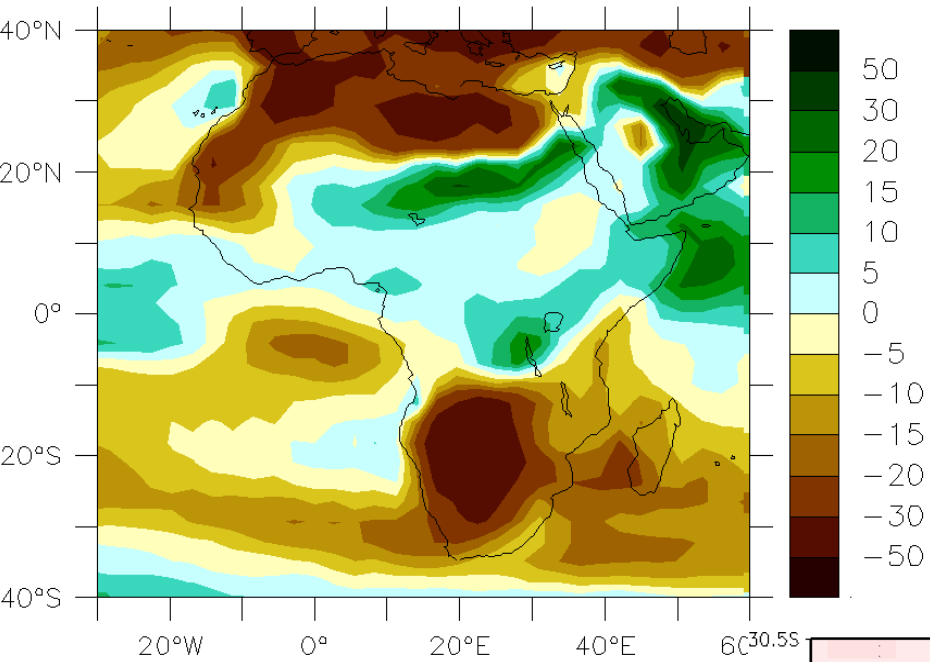


3. Scale

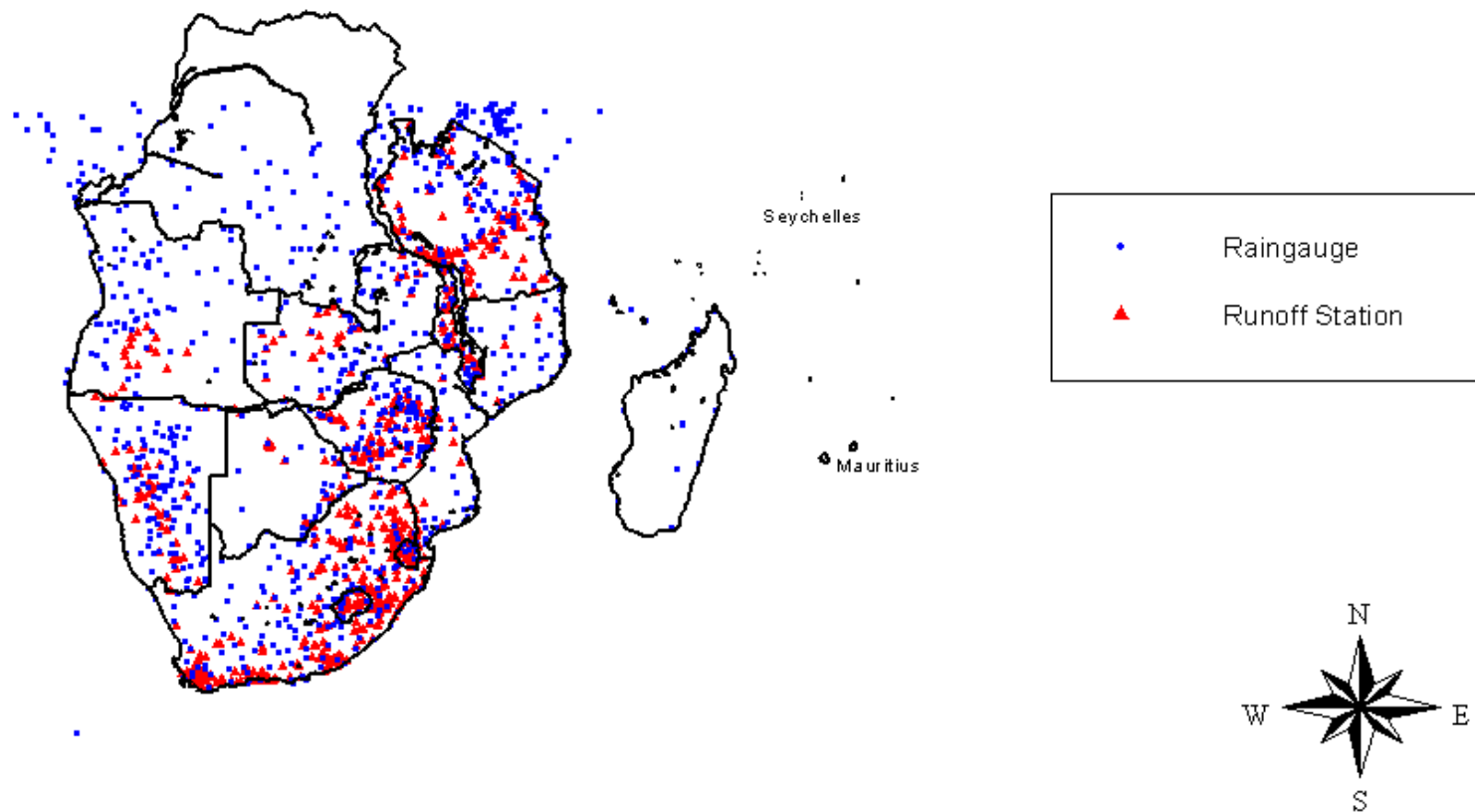
- If it is not meaningful on a farm level scale, then I will make it so...
- What is the expected variation within regions?
- When will downscaled forecasts be available and how reliable will they be?

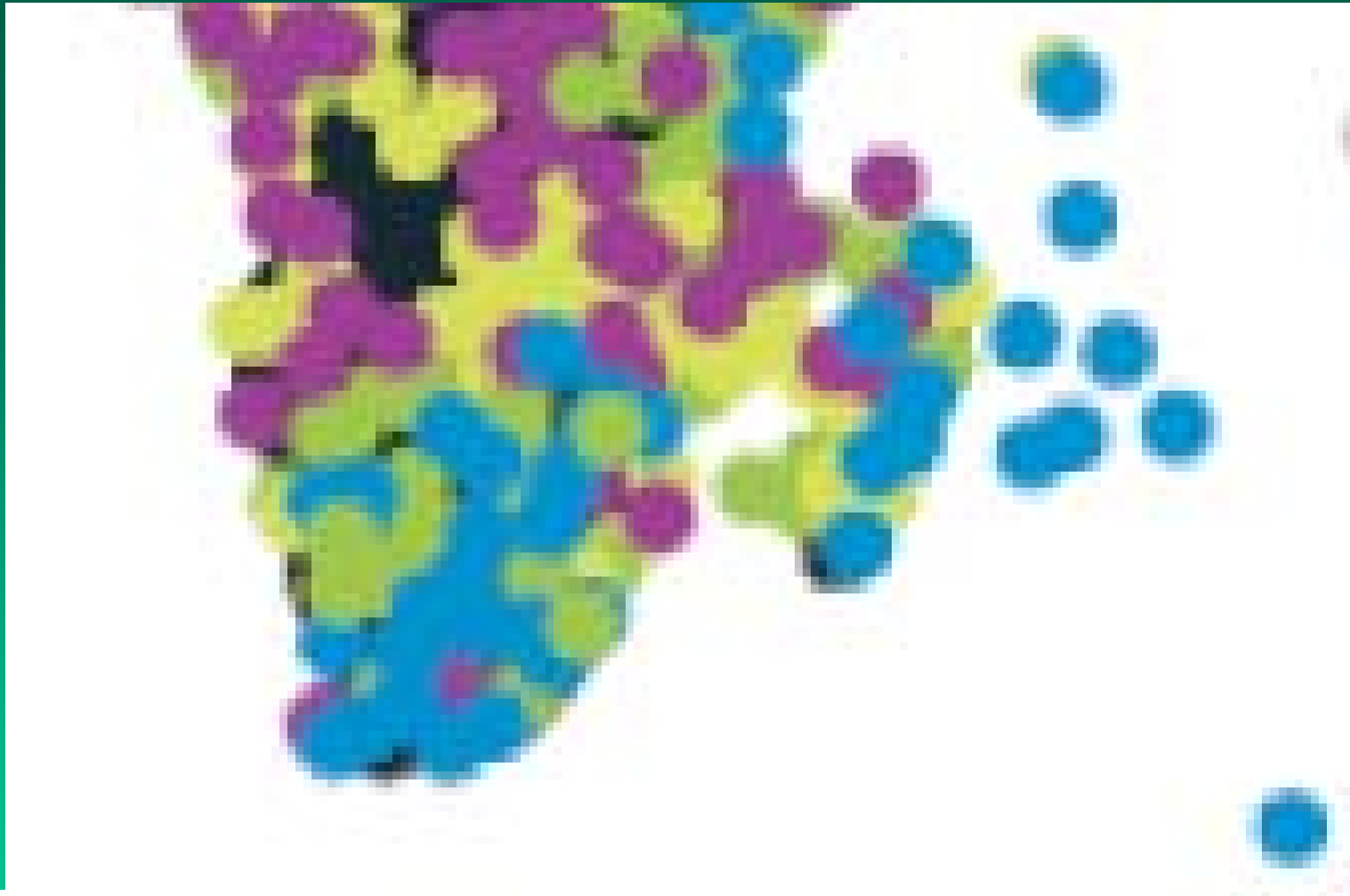


Downscaling requires local data



Spatial Distribution of Rainfall and Runoff Stations in Southern Africa





Reporting frequency to WMO from World Weather watch stations 1998-2002

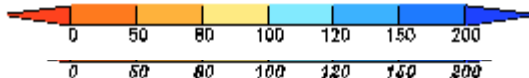
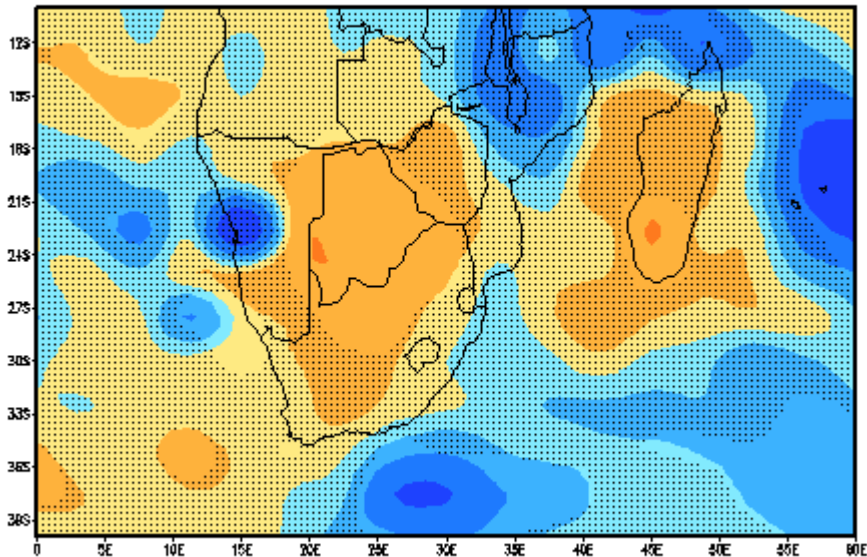
90% to 100% (2510)
50% to 90% (737)

1% to 50% (365)
Silent Stations (420)

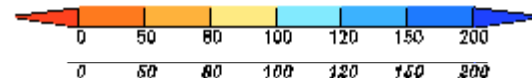
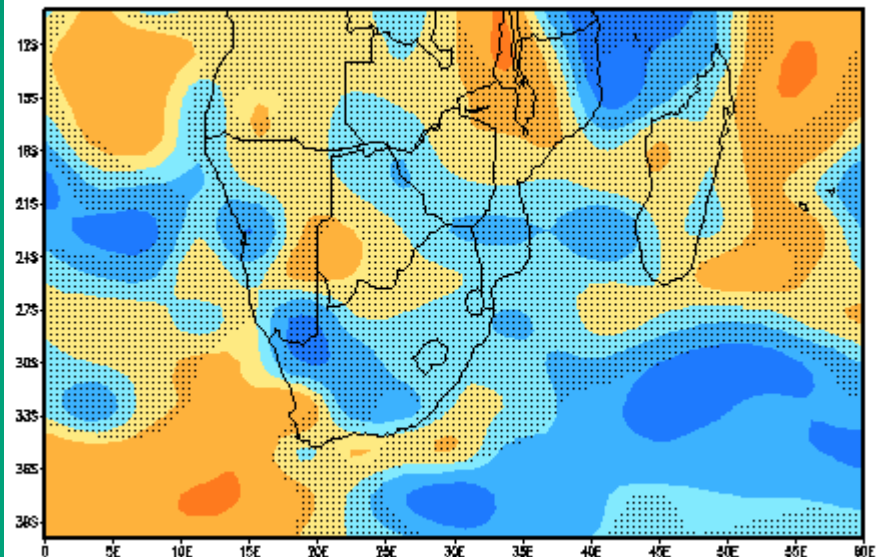
4. Consistency

- How does a particular month's forecast vary from forecast to forecast?

Nov 2006 Precipitation forecast (% of normal)
Issued on 11-09-06



Nov 2006 Precipitation forecast (% of normal)
Issued on 15-08-06



5. Interpretation

- So how will it affect my rainfall?
 - How much can I expect during the forecast period, *if I know my normal rainfall values?*

Skill	
TSUMEB	High
TSUMEB	Medium
TSUMEB	Low

Forecast: 80-100% of normal rain for the OND season

TSUMEB		
	Normal	Expected
OCT	82.6	
NOV	104.2	
DEC	112.2	
OND mm	299	239-299

RUNDU		
	Normal	Expected
OCT	99.2	
NOV	131.3	
DEC	145	
OND mm	375.5	300-376

OSHAKATI		
	Normal	Expected
OCT	79.8	
NOV	95.1	
DEC	102.3	
OND mm	277.2	221-277

WINDHOEK		
	Normal	Expected
OCT	53.8	
NOV	75.6	
DEC	96.5	
OND mm	225.9	180-226

- **What does it mean for me as a?**
 - **Farmer**
 - **Maize**
 - **Livestock**
 - **Deciduous fruit**
 - **Water resource manager**
 - **Consumer**
 - **Manufacturer**
 - **Energy suppliers**

Agriculture

- **Market expectations**
- **Hedging opportunities and strategies**
- **Alternative crops/cultivars**
- **Planting/fertilising strategy**
- **Foreign market/climate conditions**
- **Do NOT require long lead time if skill is sacrificed**

Water Resource Management

- Water supply
 - Storage
 - Restrictions
- Water disposal
- Stormwater and river flow
- Disaster management
- Demand side management
- *“Require a seamless package from hourly to annual information”*

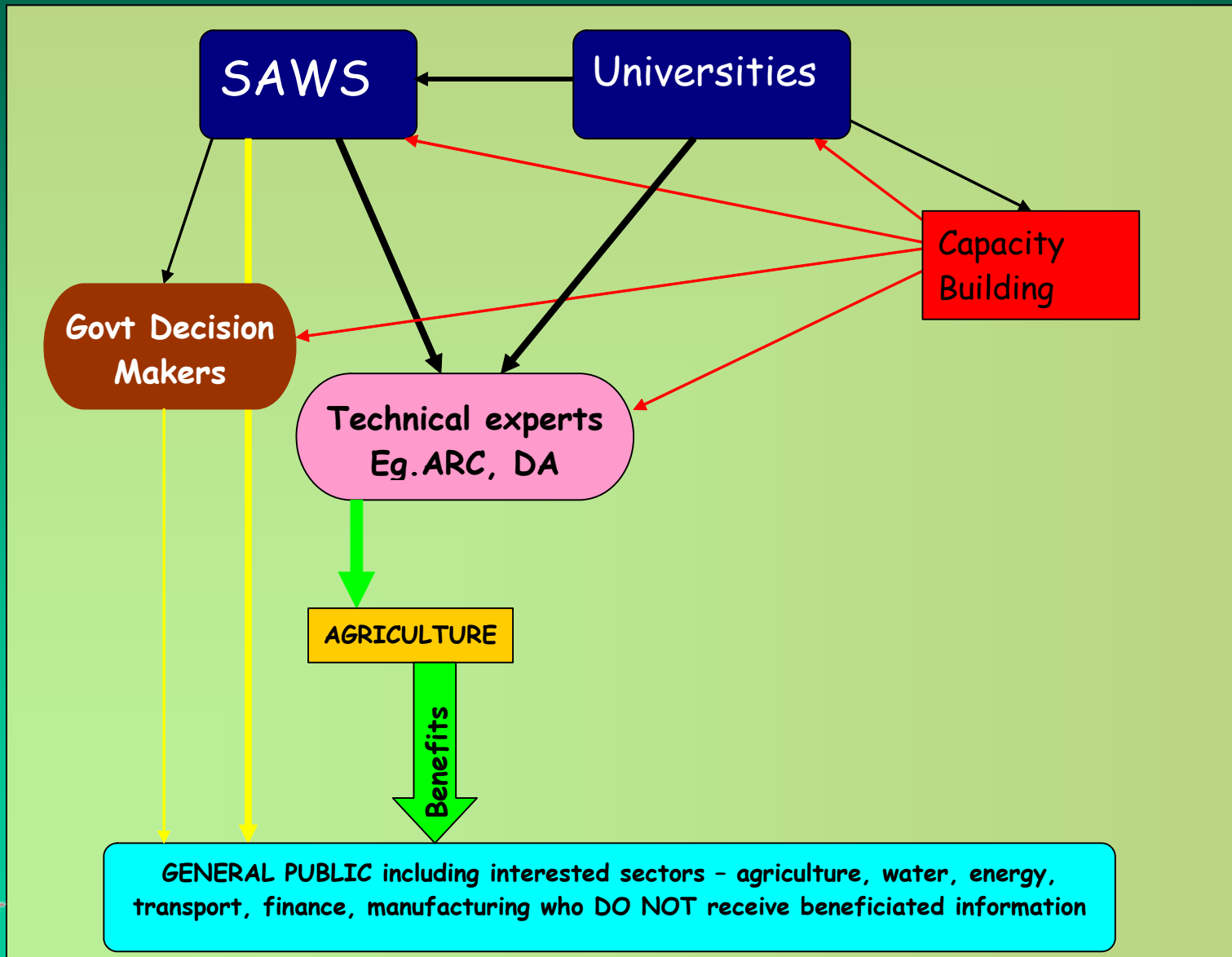
Manufacturers and Consumers

- Supply/demand ratios and cost implications
- Storage and transport of goods

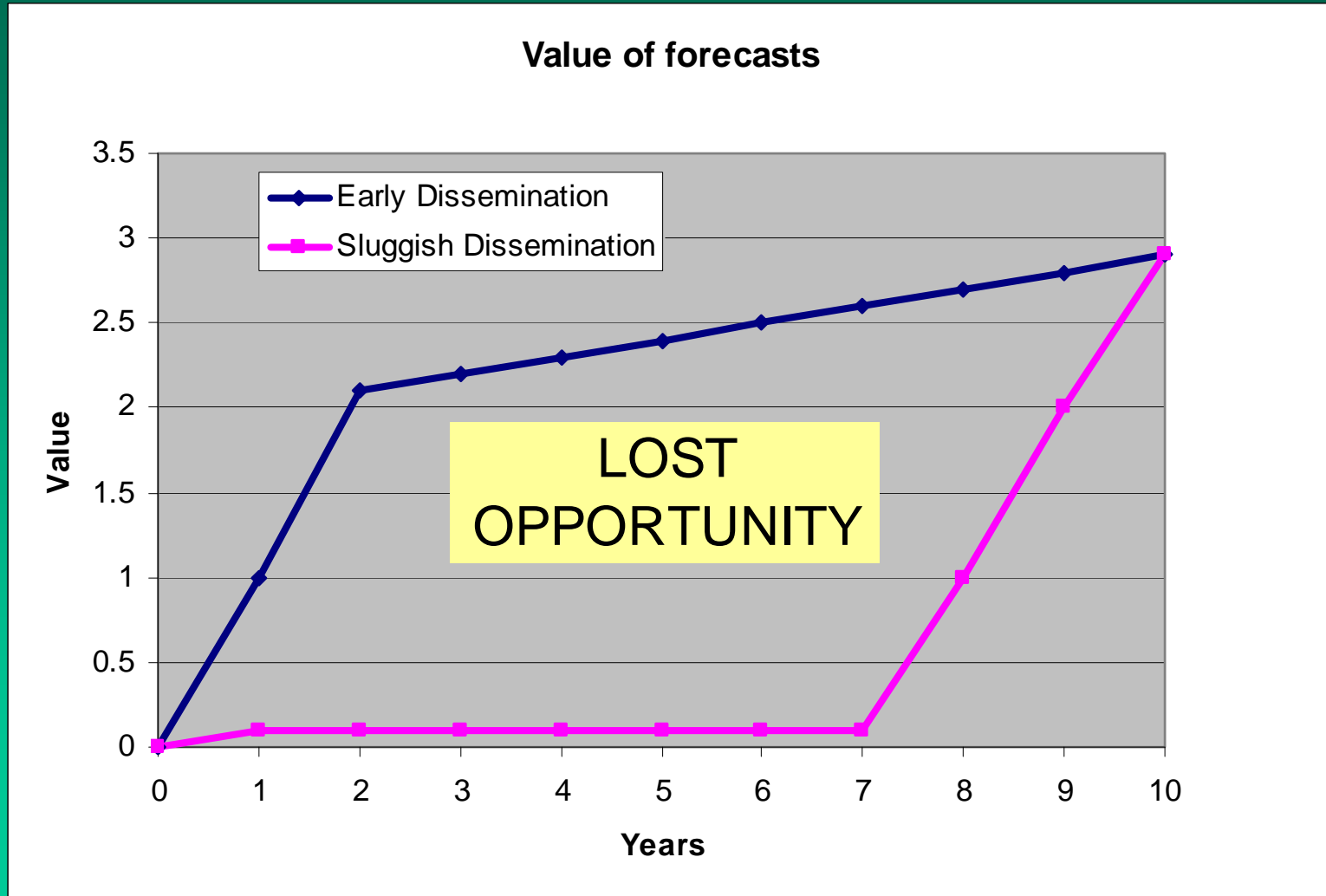
Energy suppliers

- Supply and demand and cost implications
- Long term planning

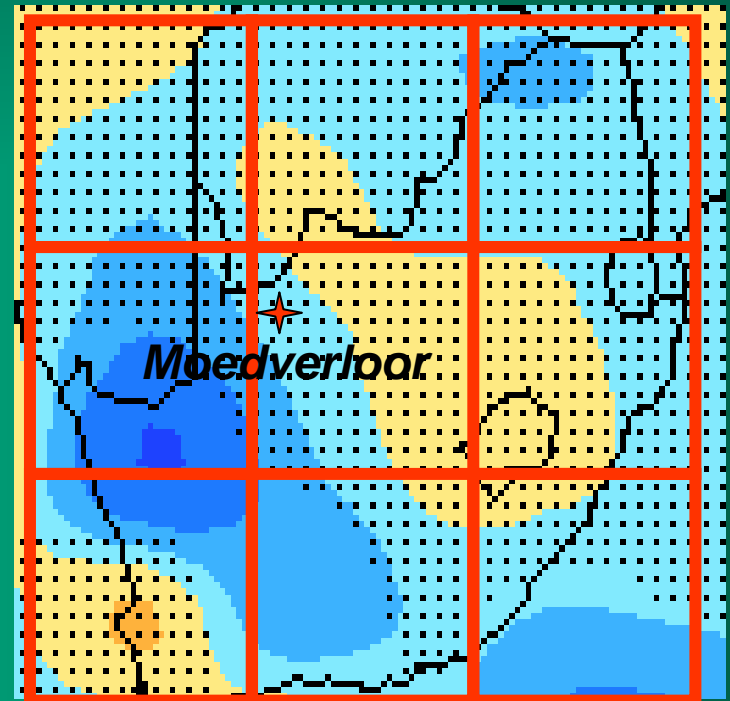
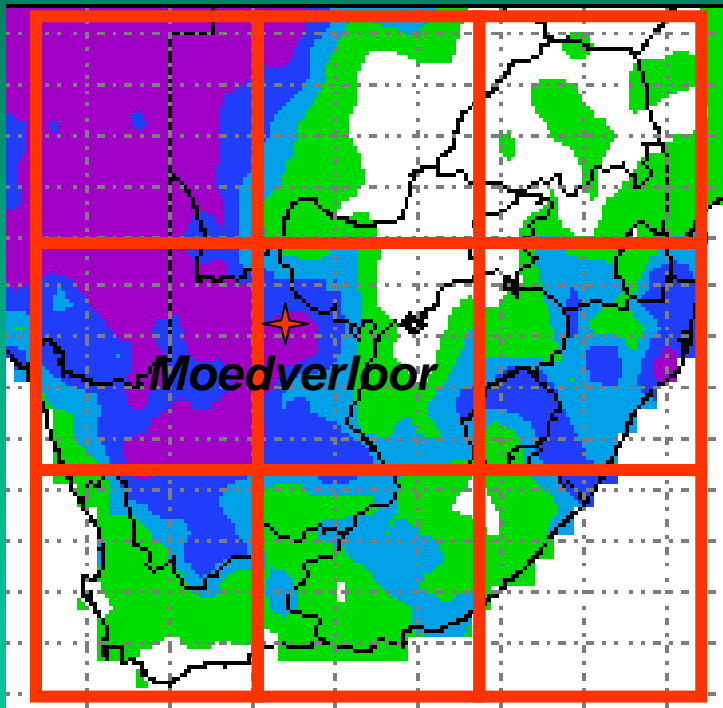
Who, how, when and where?



Forecast Value

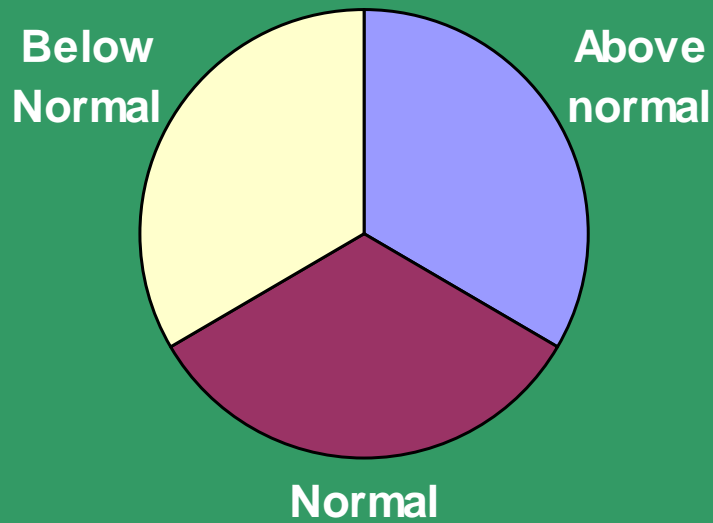


David's Dilemma

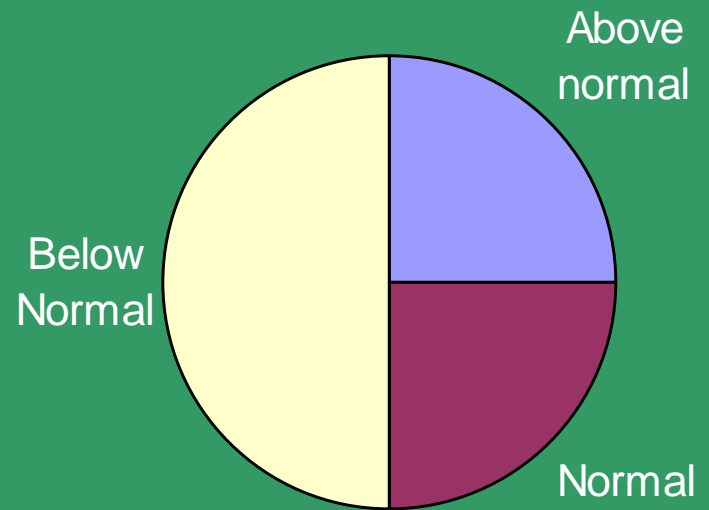


Making sense of probability

NO SIGNAL

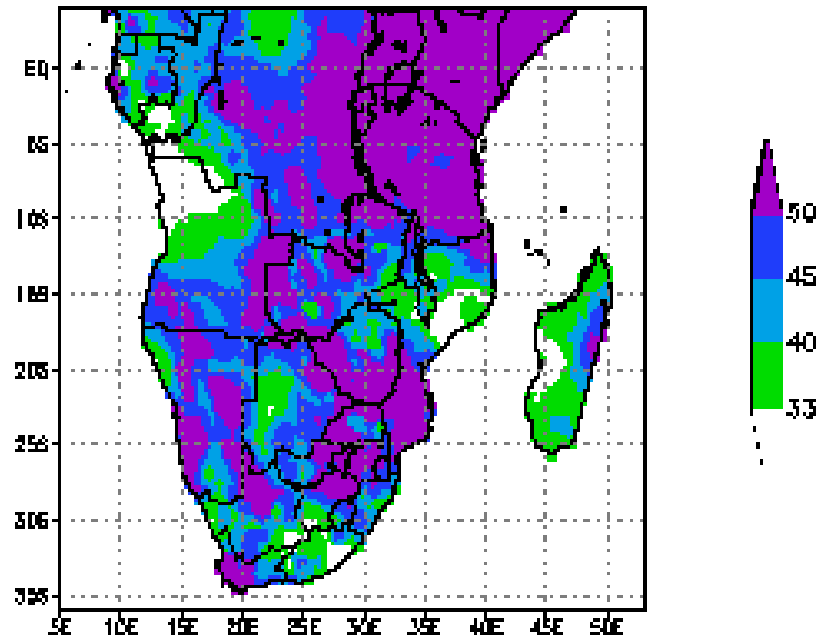


DRY SIGNAL

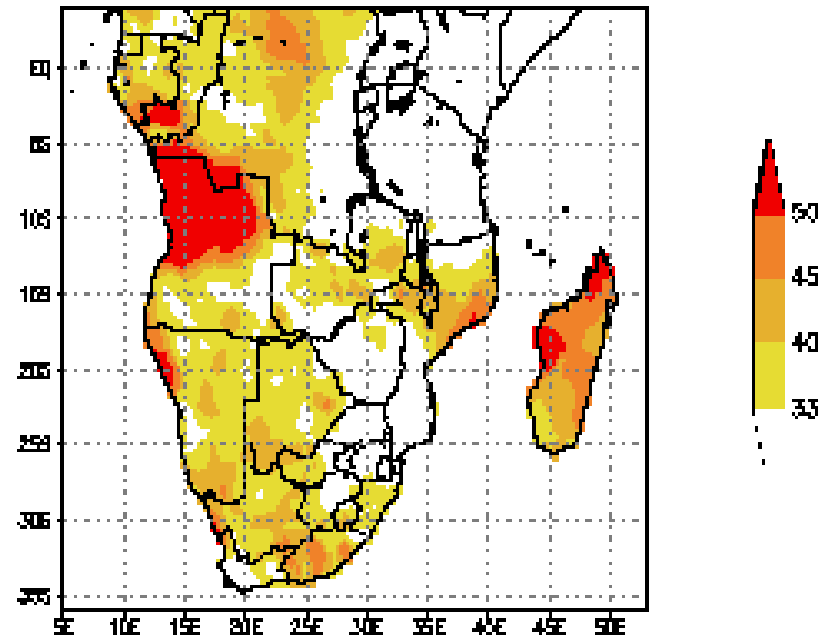


Making sense of probability

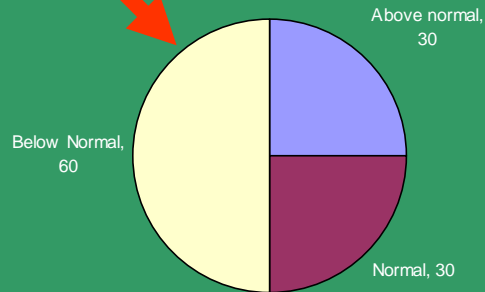
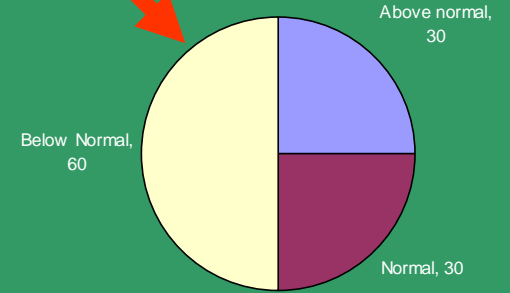
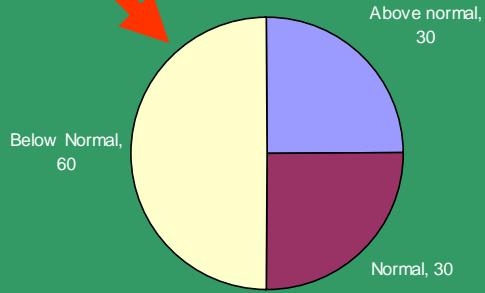
DECEMBER–JANUARY–FEBRUARY 2008/09
Above-Normal Rainfall



DECEMBER–JANUARY–FEBRUARY 2008/09
Below-Normal Rainfall



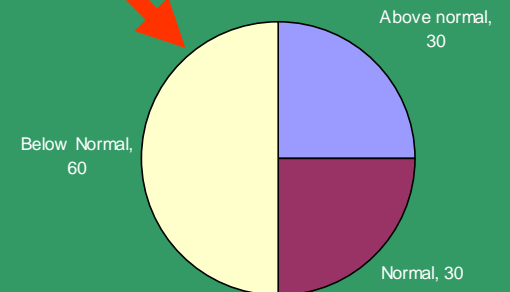
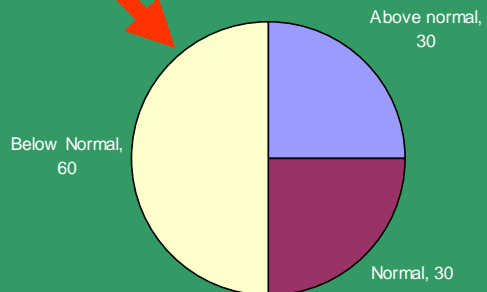
17% Drier



Above N = 25% (33.3)

Normal = 25% (33.3)

Below N = 50% (33.3)



Take home thoughts

- Can we make forecasts even more useful?
- Can we use innovative ways of disseminating them?
- Do we have the required institutional capacity and skills?
- Will climate change projection information fit seamlessly into the dissemination networks that exist?

THANK YOU



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